JC17 Rec'd PCT/PTO 0 9 MAY 2001

FORM PTO-1390 (REV 10-2000) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER: CU-2503 RJS

U.S. APPLICATION NO. (If known, see 37 CFR 1.5): 09/831417

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/AU99/00998	12 November 1999	12 November 1998

TITLE OF INVENTION
TUNING OF OPTICAL DEVICES

APPLICANT(S) FOR DO/EO/US
John CANNING et al

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. [X] This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. [ ] This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. [X] This is an express request to promptly begin national examination procedures (35 U.S.C. 371(f)).
4. [X] The US has been elected by the expiration of 19 months from the priority date (PCT Article 31).
5. [X] A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. [ ] is attached hereto (required only if not communicated by the International Bureau).
   b. [X] has been communicated by the International Bureau.
   c. [ ] is not required, as the application was filed in the United States Receiving Office (RO/US).
6. [ ] An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
7. [ ] Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. [ ] are attached hereto (required only if not communicated by the International Bureau).
   b. [ ] have been communicated by the International Bureau.
   c. [ ] have not been made; however, the time limit for making such amendments has NOT expired.
   d. [ ] have not been made and will not be made.
8. [ ] An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. [X] An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. [ ] An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11 to 16 below concern document(s) or information included:

11. [ ] An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. [X] An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. [X] A FIRST preliminary amendment.
    [ ] A SECOND or SUBSEQUENT preliminary amendment.
14. [X] A substitute specification.
15. [ ] A change of power of attorney and/or address letter.
16. [ ] Other items or information:

Express Mail Label No.:

L 698 180610

U.S. APPLICATION NO. (if known, see 37 CFR 1.5) 09/831417	INTERNATIONAL APPLICATION NO. PCT/AU99/00998	ATTORNEY'S DOCKET NUMBER CU-2503 RJS

JC08 Rec'd PCT/PTO 09 MAY 2001

	CALCULATIONS	PTO USE ONLY
17. [X] The following fees are submitted: **BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)):** Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO .... **$1000.00** International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO .... **$860.00** International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO .... **$710.00** International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4) .... **$690.00** International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) **$100.00**		
ENTER APPROPRIATE BASIC FEE AMOUNT =	$ 1000.00	
Surcharge of **$130.00** for furnishing the oath or declaration later than [ ] 20 [ ] 30 months from the earliest claimed priority date (37 CFR 1.492(e)).	$	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	10 - 20 =	0	X **$18.00**	$	
Independent claims	2 - 3 =	0	X **$80.00**	$	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ **$270.00**	$	
TOTAL OF ABOVE CALCULATIONS =				$ 1000.00	
[ ] Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2.				$	
SUBTOTAL =				$ 1000.00	
Processing fee of **$130.00** for furnishing the English translation later than [ ] 20 [ ] 30 months from the earliest claimed priority date (37 CFR 1.492(f)). +				$	
TOTAL NATIONAL FEE =				$ 1000.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property +				$ 40.00	
TOTAL FEES ENCLOSED =				$ 1040.00	
				Amount to be refunded:	$
				charged:	$

a. [X] A check in the amount of $ 1040.00 to cover the above fees is enclosed.

b. [ ] Please charge my Deposit Account No. ______ in the amount of $______ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. [X] The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 12-0400. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

Ladas & Parry
224 South Michigan Avenue
Suite 1200
Chicago, Illinois 60604
(312) 427-1300

May 9, 2001

SIGNATURE:

Richard J. Streit

NAME

25765

REGISTRATION NUMBER

L 698180610
09/831417

DOCKET: CU-2503

JC08 Rec'd PCT/PTO 0 9 MAY 2001

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

APPLICANT: John CANNING et al)
)
TITLE: TUNING OF OPTICAL DEVICES)
)
COMPLETION OF PCT/AU99/00998 filed 12 November 1999)

The Commissioner for Patents (DO/EO/US)
Box PCT
Washington, D.C. 20231

PRELIMINARY AMENDMENT

Dear Sir:

Please amend the application being filed herewith under 35 USC 371.

IN THE CLAIMS:

Please cancel all claims from the PCT application as filed as well as claims 1-11 from the claims filed in response to the Written Opinion on December 6, 2000 and substitute new claims 12-21 as attached to the substitute specification.

REMARKS

The aforesaid claims are based on the claims as filed in response to the Written Opinion in the PCT international application, with amendments to place the same in

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Substitute Spec 2/PRTS

TUNING OF OPTICAL DEVICES

Field of the Invention

The present invention relates to the thermal processing of waveguides so as to alter their properties.

Background of the Invention

The construction of planar optical waveguide devices is well known. These normally are constructed by depositing layers on top of a silicon substrate with portions of the deposited (and etched) layers being made photosensitive and subsequently being subjected to light of a wavelength selected to manipulate their optical properties. In this manner, often extremely complex optical waveguide devices can be built up on a silicon substrate.

It is desirable to provide for a system of post processing of the optical waveguide so as to tune the properties of any complex device of which the waveguide forms part.

Summary of the Invention

In accordance with a first aspect of the present invention, there is provided an optical device when subjected to localised heating, wherein the device comprises an optical waveguide and a material which absorbs a predetermined wavelength of light, the localised heating causing permanent changes in optical properties of a region of the waveguide and occurring as a result of exposing the device to light of the predetermined wavelength at an energy level sufficient to heat the material, the material being arranged to transfer at least some of the heat to the region and to minimise optically-induced alterations of the waveguide whilst the device is exposed to the light.

The localised heating can be applied by means of a laser device such as a UV or Infra Red laser device.

The device may comprise an interferometric system and the waveguide may comprise one arm of the interferometric system.

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.ceived 06 December 2000

The localised heating can be used to cause thermal relaxation, thermal diffusion or induce structural changes in the device.

In one embodiment, the localised heating is used to write a grating structure into the waveguide.

The material may be located outside the waveguide. For example, the material may comprise a substrate on which the waveguide is formed.

Alternatively, the material may be located within the waveguide.

In accordance with a second aspect of the present invention, there is provided an optical device when subjected to localised heating, wherein the device comprises an optical waveguide formed on a substrate selected to absorb a predetermined wavelength of light, the waveguide being selected to be substantially transparent to the predetermined wavelength, wherein the localised heating causes permanent changes in optical properties of a region of the waveguide, and occurs as a result of exposing the device to light of the predetermined wavelength at an energy level sufficient to heat the substrate.

The predetermined wavelength may be a sub-micron wavelength, such as 810nm. The predetermined wavelength may be absorbed by the substrate substantially at an interface with the waveguide.

Brief Description of the Drawings

Notwithstanding any other forms which may fall within

the scope of the present invention, preferred forms of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Fig. 1 illustrates schematically the process of thermal process of waveguides;

Fig. 2 illustrates an example application in a MZI type device; and

Fig. 3 illustrates an alternative form of processing of a waveguide type device.

Fig. 4 illustrates the relation between β_{stress} and β_{form} in a method embodying the present invention.

Description of Preferred and Other Embodiments

In the preferred embodiment, local thermal processing of a wafer is carried out utilizing an infra-red or UV laser device. Suitable thermally sensitive waveguides, including a negative index grating within a germanosilicate planar waveguide, can be produced by utilizing a hollow cathode plasma enhanced chemical vapour deposition (HCPECVD)process such as that outlined in M V Bazylenko, M Gross, A Simonian, P L Chu, Journal of Vacuum Science and Technology, A14, (2) pp336-345, 1996 and J Canning, D Moss, M Aslund, M Bazylenko, Election Letters, 34(4) pp366-367 (1998).

Turning now to Figure 1, the localised heating is preferably in the region of the waveguide 1 so as to alter its optical properties. Preferably, the thermal processing utilised is designed to have minimal other effects on the waveguide 1.

Hence, if a UV laser is to be utilised then it may be utilised on a silicon substrate 2 which is opaque to UV rays, as illustrated by arrow 10, whilst an IR laser may be utilised from above the waveguide 1 as illustrated by arrow 12.

The localised heating can be utilised to cause localised changes in the device 14. The changes can include thermal relaxation of internal stresses, thermal diffusion of material or thermal damage of material layers.

For example, Fig. 2 illustrates an add-drop multiplexer 10 constructed utilizing a Mach-Zehnder principle which can be initially constructed on a wafer and subsequently tuned by means of thermal rather than UV tuning of the arms at the points eg. 11, 12.

Where it is desired to utilise local radiation which may cause undesirable effects in the waveguide 100, as illustrated in Fig. 3, an opaque layer eg. 15 can be formed over the waveguide 100 so as to minimise photosensitive alterations in the area of waveguide 100.

The utilisation of local heating can have a number of uses. Firstly, as noted previously, there is its utilisation to change waveguide properties. Such utilisation would be ideal for example in Mach-Zehnder type devices. Other devices could include multimode devices wherein each arm can be thermally processed so as to adjust properties.

An alternative use for localised thermal heating is the localised heating of the substrate/wafer to control or release stresses through annealing or damaging of the wafer. E.g. it is known to construct optical waveguide devices having internal waveguide structures utilizing plasma enhanced chemical vapour deposition processes on a silicon substrate. Unfortunately, often non-symmetrical birefringence effects will result form the formation process. The first birefringent effect denoted β_{form} will be due to the circumference characteristics of the waveguide. The second effect denoted β_{stress} will be due to several stresses associated with the thermal coefficient mismatch of the substrate and deposited layer.

In an embodiment of the present invention, localised thermal heating of the above described structure could thus provide a method to alter the overall birefringence in the waveguide by either releasing existing stresses or introducing further stresses. E.g, as illustrated in Figure 4, where the "sign" of β_{stress} 200 is opposed to that of

β_{form} 202, the resultant birefringence 204 can be nullified by introducing further stresses in the direction of β_{stress} 200.

Alternatively, the localised thermal heating can be utilised as a form of annealing so as to slowly anneal the whole of a wafer whilst simultaneously measuring the waveguide properties. In this manner, the whole of the substrate can be thermally annealed on a mount with localised heating providing for a more precise annealing than that available through the utilisation of general convection heating. In this manner, the thermal annealing can be closely monitored and altered at any particular point.

The principle of localised thermal heating can be extended to the actual direct writing of thermally created device structures utilizing a small spot size for thermally induced rather than optically-induced alteration of the waveguide. Again, this can be utilised for post processing of a waveguide so as to perform tuning or, alternatively, for the construction of more complex waveguide devices.

An example application is a process of polarisation control by heating of a substrate. An ideal laser source can be a diode bar array at 810nm which is absorbed by the substrate and the waveguide. A CO/CO_2 laser can be used to heat the surface and affect the internal waveguides. Further, the devices can be tuned either at the waveguide or at the substrate. Preferably, an IR source is used so as to thermally heat and not damage the substrate.

It would be appreciated by a person skilled in the art that numerous variations and/or modifications may be made to the present invention as shown in the specific embodiments without departing from the spirit or scope of the invention as broadly described. The present embodiments are, therefore, to be considered in all respects to be illustrative and not restrictive.

We Claim:

12. An optical device when subjected to localized heating, wherein the device comprises an optical waveguide and a material which absorbs a predetermined wavelength of light, the localized heating causing permanent changes in optical properties of a region of the waveguide and occurring as a result of exposing the device to light of the predetermined wavelength at an energy level sufficient to heat the material, the material being arranged to transfer at least some of the heat to the region and to minimize optically-induced alterations of the waveguide whilst the device is exposed to the light.

13. An optical device in accordance with claim 12 wherein the material is located outside the waveguide.

14. An optical device in accordance with claim 12 wherein the material is located within the waveguide.

15. An optical device in accordance with claim 12 wherein the material comprises a substrate on which the waveguide is formed.

16. An optical device in accordance with claim 12 wherein the device comprises an interferometric system and the waveguide comprises one arm of the interferometric system.

17. An optical device in accordance with claim 12 wherein the localized heating causes thermal relaxation, thermal diffusion or induces damage in the material.

18. An optical device in accordance with claim 12 wherein the localized heating is used to write a grating structure in the waveguide.

19. An optical device when subjected to localized heating, wherein the device comprises an optical waveguide formed on a substrate selected to absorb a predetermined wavelength of light, the waveguide being selected to be substantially transparent to the predetermined wavelength, wherein the localized heating causes permanent changes in optical properties of a region of the waveguide, and occurs as a result of exposing the device to light of the predetermined wavelength at an energy level sufficient to heat the substrate.

20. An optical device in accordance with claim 19 wherein the predetermined wavelength of light is a sub-micron wavelength.

21. An optical device in accordance with either claim 19 or claim 20 wherein the predetermined wavelength of light is absorbed by the substrate substantially at an interface with the waveguide.

ABSTRACT

A method of tuning an optical device comprising a waveguide, the method comprising the step of applying a localised heating to the device in order to change the optical properties of the waveguide.

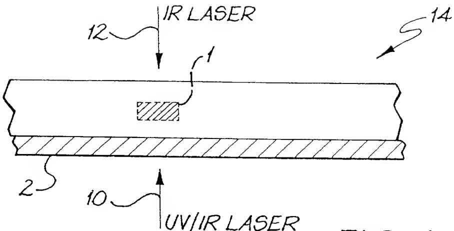

FIG. 1

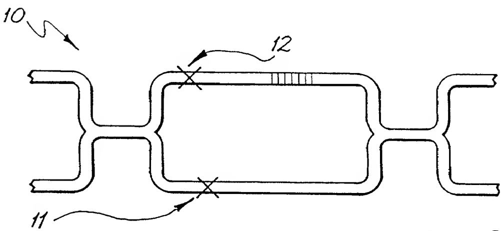

FIG. 2

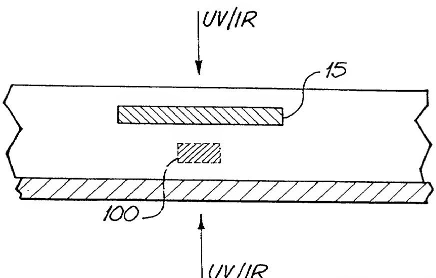

FIG. 3

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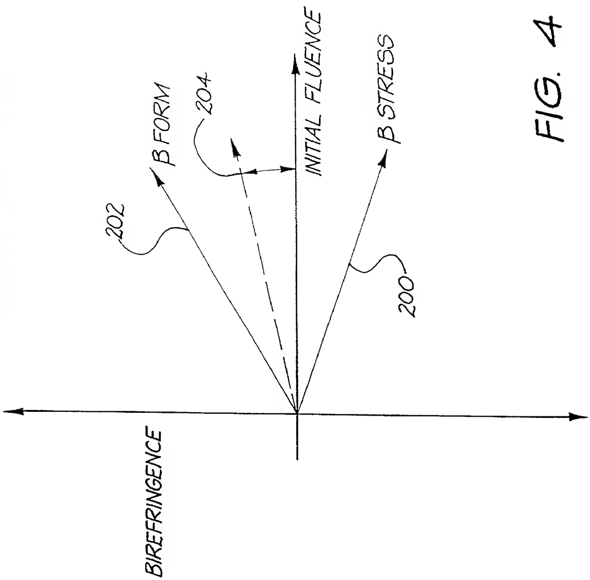

FIG. 4

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TUNING OF OPTICAL DEVICES

Field of the Invention

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Background of the Invention

The construction of planar optical waveguide devices is well known. These normally are constructed by depositing layers on top of a silicon substrate with portions of the deposited (and etched) layers being made photosensitive and subsequently being subjected to light of a wavelength selected to manipulate their optical properties. In this manner, often extremely complex optical waveguide devices can be built up on a silicon substrate.

It is desirable to provide for a system of post processing of the optical waveguide so as to tune the properties of any complex device of which the waveguide forms part.

Summary of the Invention

In accordance with a first aspect of the present invention, there is provided an optical device when subjected to localised heating, wherein the device comprises an optical waveguide and a material which absorbs a predetermined wavelength of light, the localised heating causing permanent changes in optical properties of a region of the waveguide and occurring as a result of exposing the device to light of the predetermined wavelength at an energy level sufficient to heat the material, the material being arranged to transfer at least some of the heat to the region and to minimise optically-induced alterations of the waveguide whilst the device is exposed to the light.

The localised heating can be applied by means of a laser device such as a UV or Infra Red laser device.

The device may comprise an interferometric system and the waveguide may comprise one arm of the interferometric system.

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The localised heating can be used to cause thermal relaxation, thermal diffusion or induce structural changes in the device.

In one embodiment, the localised heating is used to write a grating structure into the waveguide.

The material may be located outside the waveguide. For example, the material may comprise a substrate on which the waveguide is formed.

Alternatively, the material may be located within the waveguide.

In accordance with a second aspect of the present invention, there is provided an optical device when subjected to localised heating, wherein the device comprises an optical waveguide formed on a substrate selected to absorb a predetermined wavelength of light, the waveguide being selected to be substantially transparent to the predetermined wavelength, wherein the localised heating causes permanent changes in optical properties of a region of the waveguide, and occurs as a result of exposing the device to light of the predetermined wavelength at an energy level sufficient to heat the substrate.

The predetermined wavelength may be a sub-micron wavelength, such as 810nm. The predetermined wavelength may be absorbed by the substrate substantially at an interface with the waveguide.

Brief Description of the Drawings

Notwithstanding any other forms which may fall within

the scope of the present invention, preferred forms of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Fig. 1 illustrates schematically the process of thermal process of waveguides;

Fig. 2 illustrates an example application in a MZI type device; and

Fig. 3 illustrates an alternative form of processing of a waveguide type device.

Fig. 4 illustrates the relation between β_{stress} and β_{form} in a method embodying the present invention.

Description of Preferred and Other Embodiments

In the preferred embodiment, local thermal processing of a wafer is carried out utilizing an infra-red or UV laser device. Suitable thermally sensitive waveguides, including a negative index grating within a germanosilicate planar waveguide, can be produced by utilizing a hollow cathode plasma enhanced chemical vapour deposition (HCPECVD)process such as that outlined in M V Bazylenko, M Gross, A Simonian, P L Chu, Journal of Vacuum Science and Technology, A14, (2) pp336-345, 1996 and J Canning, D Moss, M Aslund, M Bazylenko, Election Letters, 34(4) pp366-367 (1998).

Turning now to Figure 1, the localised heating is preferably in the region of the waveguide 1 so as to alter its optical properties. Preferably, the thermal processing utilised is designed to have minimal other effects on the waveguide 1.

Hence, if a UV laser is to be utilised then it may be utilised on a silicon substrate 2 which is opaque to UV rays, as illustrated by arrow 10, whilst an IR laser may be utilised from above the waveguide 1 as illustrated by arrow 12.

The localised heating can be utilised to cause localised changes in the device 14. The changes can include thermal relaxation of internal stresses, thermal diffusion of material or thermal damage of material layers.

For example, Fig. 2 illustrates an add-drop multiplexer 10 constructed utilizing a Mach-Zehnder principle which can be initially constructed on a wafer and subsequently tuned by means of thermal rather than UV tuning of the arms at the points eg. 11, 12.

Where it is desired to utilise local radiation which may cause undesirable effects in the waveguide 100, as illustrated in Fig. 3, an opaque layer eg. 15 can be formed over the waveguide 100 so as to minimise photosensitive alterations in the area of waveguide 100.

The utilisation of local heating can have a number of uses. Firstly, as noted previously, there is its utilisation to change waveguide properties. Such utilisation would be ideal for example in Mach-Zehnder type devices. Other devices could include multimode devices wherein each arm can be thermally processed so as to adjust properties.

An alternative use for localised thermal heating is the localised heating of the substrate/wafer to control or release stresses through annealing or damaging of the wafer. E.g. it is known to construct optical waveguide devices having internal waveguide structures utilizing plasma enhanced chemical vapour deposition processes on a silicon substrate. Unfortunately, often non-symmetrical birefringence effects will result form the formation process. The first birefringent effect denoted β_{form} will be due to the circumference characteristics of the waveguide. The second effect denoted β_{stress} will be due to several stresses associated with the thermal coefficient mismatch of the substrate and deposited layer.

In an embodiment of the present invention, localised thermal heating of the above described structure could thus provide a method to alter the overall birefringence in the waveguide by either releasing existing stresses or introducing further stresses. E.g, as illustrated in Figure 4, where the "sign" of β_{stress} 200 is opposed to that of

β_{form} 202, the resultant birefringence 204 can be nullified by introducing further stresses in the direction of β_{stress} 200.

Alternatively, the localised thermal heating can be utilised as a form of annealing so as to slowly anneal the whole of a wafer whilst simultaneously measuring the waveguide properties. In this manner, the whole of the substrate can be thermally annealed on a mount with localised heating providing for a more precise annealing than that available through the utilisation of general convection heating. In this manner, the thermal annealing can be closely monitored and altered at any particular point.

The principle of localised thermal heating can be extended to the actual direct writing of thermally created device structures utilizing a small spot size for thermally induced rather than optically-induced alteration of the waveguide. Again, this can be utilised for post processing of a waveguide so as to perform tuning or, alternatively, for the construction of more complex waveguide devices.

An example application is a process of polarisation control by heating of a substrate. An ideal laser source can be a diode bar array at 810nm which is absorbed by the substrate and the waveguide. A CO/CO_2 laser can be used to heat the surface and affect the internal waveguides. Further, the devices can be tuned either at the waveguide or at the substrate. Preferably, an IR source is used so as to thermally heat and not damage the substrate.

It would be appreciated by a person skilled in the art that numerous variations and/or modifications may be made to the present invention as shown in the specific embodiments without departing from the spirit or scope of the invention as broadly described. The present embodiments are, therefore, to be considered in all respects to be illustrative and not restrictive.

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We Claim:

1. An optical device when subjected to localised heating, wherein the device comprises an optical waveguide and a material which absorbs a predetermined wavelength of light, the localised heating causing permanent changes in optical properties of a region of the waveguide and occurring as a result of exposing the device to light of the predetermined wavelength at an energy level sufficient to heat the material, the material being arranged to transfer at least some of the heat to the region and to minimise optically-induced alterations of the waveguide whilst the device is exposed to the light.

2. An optical device in accordance with claim 1 wherein the material is located outside the waveguide.

3. An optical device in accordance with claim 1 wherein the material is located within the waveguide.

4. An optical device in accordance with claim 1 wherein the material comprises a substrate on which the waveguide is formed.

5. An optical device in accordance with any one of the proceeding claims wherein the device comprises an interferometric system and the waveguide comprises one arm of the interferometric system.

6. An optical device in accordance with any one of the proceeding claims wherein the localised heating causes thermal relaxation, thermal diffusion or induces damage in the material.

7. An optical device in accordance with any one of the proceeding claims wherein the localised heating is used to write a grating structure in the waveguide.

8. An optical device when subjected to localised heating, wherein the device comprises an optical waveguide formed on a substrate selected to absorb a predetermined wavelength of light, the waveguide being selected to be substantially transparent to the predetermined wavelength, wherein the localised heating causes permanent changes in optical properties of a region of the waveguide, and occurs

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as a result of exposing the device to light of the predetermined wavelength at an energy level sufficient to heat the substrate.

9. An optical device in accordance with claim 8 wherein the predetermined wavelength of light is a sub-micron wavelength.

10. An optical device in accordance with either claim 8 or claim 9 wherein the predetermined wavelength of light is absorbed by the substrate substantially at an interface with the waveguide.

11. An optical device substantially as herein described with reference to the accompanying drawings.

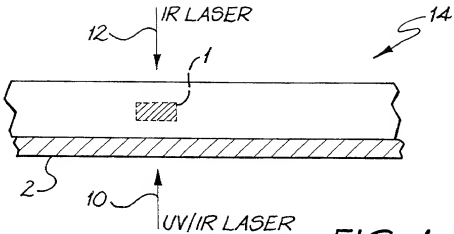

FIG. 1

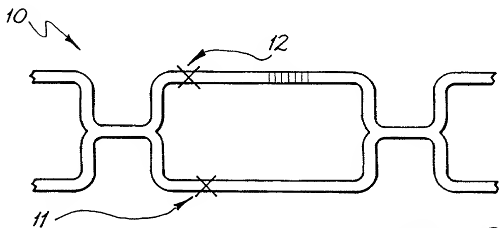

FIG. 2

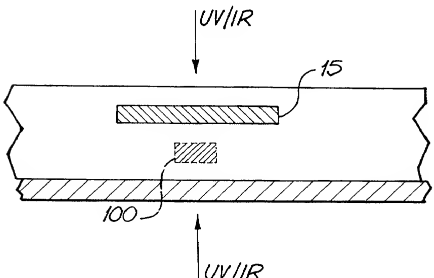

FIG. 3

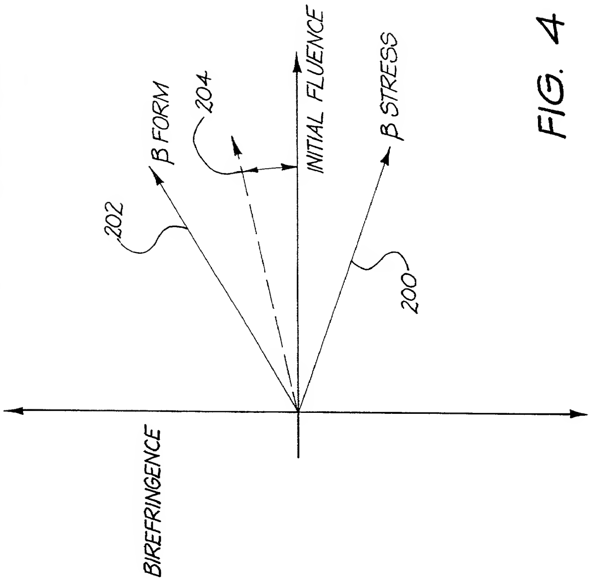

FIG. 4

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+PATENT

Docket: CU-2503

COMBINED DECLARATION AND POWER OF ATTORNEY

(ORIGINAL, DESIGN, NATIONAL STAGE OF PCT, SUPPLEMENTAL, DIVISIONAL, CONTINUATION OR CIP)

As a below named inventor, I hereby declare that:

TYPE OF DECLARATION

This declaration is of the following type: *(check one applicable item below)*

- ☐ original
- ☐ design
- ☐ supplemental

Note: If the Declaration is for an International Application being filed as a divisional, continuation or continuation-in-part application, do not check next item; check appropriate one of last three items.

- ☒ national stage of PCT

Note: If one of the following 3 items apply, then complete and also attach ADDED PAGES FOR DIVISIONAL, CONTINUATION OR CIP.

- ☐ divisional
- ☐ continuation
- ☐ continuation-in-part (CIP)

INVENTORSHIP IDENTIFICATION

WARNING: If the inventors are each not the inventors of all the claims, an explanation of the facts, including the ownership of all the claims at the time the last claimed invention was made, should be submitted.

My residence, post office address and citizenship are as stated below, next to my name. I believe that I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter that is claimed, and for which a patent is sought on the invention entitled:

TITLE OF INVENTION

TUNING OF OPTICAL DEVICES

SPECIFICATION IDENTIFICATION

the specification of which: *(complete (a), (b) or (c))*

☐ (a) is attached hereto.

Your Ref: CRC 24, 27

the specification of which: *(complete (a), (b) or (c))*

☐ (a) is attached hereto.

☐ (b) was filed on ______________ as ☐ Serial No. ______________ or ☐Express Mail No. *(as Serial No. not yet known)* ______________ and was amended on ______________ *(if applicable).*

Note: Amendments filed after the original papers are deposited with the PTO that contain new matter are not accorded a filing date by being referred to in the Declaration. Accordingly, the amendments involved are those filed with the application papers or, in the case of a supplemental Declaration, are those amendments claiming matter not encompassed in the original statement of invention or claims. See 37 CFR 1.67.

☒ (c) was described and claimed in PCT International Application No. PCT/AU99/00998 filed on 12 November 1999 and as amended under PCT Article 34 on 6 December 2000.

ACKNOWLEDGEMENT OF REVIEW OF PAPERS AND DUTY OF CANDOR

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information, which is material to patentability as defined in 37, Code of Federal Regulations, § 1.56,

(also check the following items, if desired)

☐ and which is material to the examination of this application, namely, information where there is a substantial likelihood that a reasonable Examiner would consider it important in deciding whether to allow the application to issue as a patent, and

☐ in compliance with this duty, there is attached an information disclosure statement, in accordance with 37 CFR 1.98.

PRIORITY CLAIM (35 U.S.C. § 119(a)-(d))

I hereby claim foreign priority benefits under Title 35, United States Code, § 119(a)-(d) of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

(complete (d) or (e))

☐ (d) no such applications have been filed.

☒ (e) such applications have been filed as follows.

Note: Where item (c) is entered above and the international application which designated the U.S. itself claimed priority check item (e), enter the details below and make the priority claim.

PRIOR FOREIGN/PCT APPLICATION(S) FILED WITHIN 12 MONTHS (6 MONTHS FOR DESIGN) PRIOR TO THIS APPLICATION AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. § 119(a)-(d)

COUNTRY (OR INDICATE IF PCT	APPLICATION NUMBER	DATE OF FILING (day/month/year)	PRIORITY CLAIMED UNDER 35 USC 119
Australia	PP 7166	12 November 1998	☒ YES NO ☐
Australia	PP 7167	12 November 1998	☒ YES NO ☐
			☐ YES NO ☐

Your Ref: CRC 24, 27

			☐ YES NO ☐
			☐ YES NO ☐

CLAIM FOR BENEFIT OF PRIOR U.S. PROVISIONAL APPLICATION(S) (34 U.S.C. § 119(e))

I hereby claim the benefit under Title 35, United States Code, § 119(e) of any United States provisional application(s) listed below:

PROVISIONAL APPLICATION NUMBER	FILING DATE

ALL FOREIGN APPLICATION(S), IF ANY, FILED MORE THAN 12 MONTHS (6 MONTHS FOR DESIGN) PRIOR TO THIS U.S. APPLICATION

Note: If the application filed more than 12 months from the filing date of this application is a PCT filing forming the basis for this application entering the United States as (1) the national stage or (2) a continuation, divisional, or continuation-in-part, then also complete ADDED PAGES TO COMBINED DECLARATION AND POWER OF ATTORNEY FOR DIVISIONAL, CONTINUATION OR CIP APPLICATION for benefit of the prior U.S. or PCT application(s) under 35 U.S.C. § 120.

POWER OF ATTORNEY

I hereby appoint the following practitioner(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith *(list name and registration number)*.

Thomas F. Peterson, 24790; Richard J. Streit, 25765; Donald P. Reynolds, 26220; W. Dennis Drehkoff, 27193; Vangelis Economou, 32341; Brian W. Hameder, 45613; Paul B. West, 18947; Joseph H. Handelman, 26179; Peter D. Galloway 27885; John Richards, 31503; Iain C. Baillie, 24090; Richard P. Berg, 28145

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☐ Attached, as part of this declaration and power of attorney, is the authorization of the above-named practitioner(s) to accept and follow instructions from my representative(s).

SEND CORRESPONDENCE TO:

Thomas F. Peterson
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224 South Michigan Avenue
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DIRECT TELEPHONE CALLS TO:
(Name and telephone number)

Your Ref: CRC 24, 27

SIGNATURE(S)

Note: Carefully indicate the family (or last) name, as it should appear on the filing receipt and all other documents.

Full name of first joint inventor

1-a

John		CANNING
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Inventor's signature

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Full name of second joint inventor

2-a

Mattias		ASLUND
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DECLARATION

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.